

TEK-234
286 STD-BUS COMPUTER
HARDWARE REFERENCE MANUAL
VERSION 1.1, June 1992

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NOTE

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FOREWORD

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This document may contain or reference information and products protected by the copyrights or patents of others and does not convey any license under the patent right of Teknor, nor the rights of others.

This manual does not discuss standard features of the IBM family of Personal Computers. Instead, it focuses on the superset of features that TEKNOR has implemented into its single board computers.

For information on IBM standard features, please refer to the following books available at your local book stores:

- *IBM AT Technical Reference Manual*
- *DOS Technical Reference*
- *Peter Norton's Programming The IBM PC*

This is by no means an exhaustive list. Many titles exist on these subjects and just as many titles deal with specialized applications such as extended memory transfers, disk drives, EMS, and so on.

If you require information not covered in this manual or in our Application Notes releases, contact our Technical Support/Services Department at (514) 437-5682.

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INTRODUCTION

SECTION 1

The TEK-234 is a high performance PC/AT type computer on the STD format. It integrates all the basic functions available on IBM ATs with standard features like a hard disk interface and floppy disk controller.

Best of all, the TEK-234 is designed to operate in environments where a sturdy and compact system is essential. So elements such as a watchdog timer, solid state disks, and a power failure detector were added to make the TEK-234 perform even in the most extreme industrial applications.

Built using CMOS technology, the TEK-234 consumes very little power, typically less than 7.5 watts. And to top it off, an XT expansion header accommodates TEKNOR's TEK-PG VGA LCD/EL series of display controllers or other optional expansion cards.

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Here are more exciting features found on the TEK-234 STD bus single board computer:

- 80C286 @ 16Mhz
- 512K or 2M of DRAM
- Up to 512K user EPROM/Flash EPROM
- Up to 1M user Static-RAM with battery backup
- Supports Shadow RAM BIOS for fast execution
- Flash EPROM boot
- Real-time clock with battery backup
- AT keyboard and speaker port
- One parallel printer port (LPT1)
- Two serial ports with COM2 as RS232 or RS485
- Watchdog Timer
- Onboard floppy controller: drives two floppies
- Onboard IDE hard disk interface
- CMOS technology for low power
- Two year warranty

UNPACKING

If the TEK-234 appears to be damaged, please notify Teknor immediately. Save the box and packing material in case you need to ship the card back in the future. The TEK-234 is comprised of the card itself, a 3.5" floppy disk containing the utilities, this manual, and a software utility manual. The TEK-234 is preconfigured at the factory to operate as a standard IBM AT processor card.

BASIC MODES OF OPERATION

The TEK-234 has two basic modes of operation: stand alone mode and the PC/AT. The PC/AT operates like an IBM AT processor card, with video and disk controller cards. The stand alone mode depends on a user supplied PC or VT100 to support the transmission of programs and commands.

STD Passive Backplane

The TEK-234 can be used in an STD Passive Backplane in conjunction with any STD compatible cards. Power is drawn directly from the bus. Video cards may be used but are not a prerequisite for operation.



To avoid damage, make certain the power is off before inserting or retrieving a card from the passive backplane.

User Interface

The TEK-234 operates with any STD Bus compatible display card. Or, if stand-alone mode is desired, an

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optional TEK-PG piggyback VGA card may be used.

A VT100 terminal (or a PC emulating VT100) may be used as an inexpensive alternative to a display and keyboard. Refer to Section 5, *Using VT100 Mode* for more details on this procedure.

Stand-Alone Operation

In situations where a full Passive Backplane system is not appropriate, the TEK-234 can operate in *Stand-Alone Mode*.

In fact, by utilizing a TEK-PG graphics card, you can assemble a complete computer in a single STD card format.

And when your application calls for it, the TEK-234 is fully operational without any user interfaces at all - running without disks, keyboard, and video.

Diskless Operation

The TEK-234 can operate without mechanical drives in any basic mode of operation. A Flash disk can be configured as a bootable disk and temporary data may be securely stored on SRAM disks.

In essence, the TEK-234 is an ideal industrial controller withstanding shock, vibration, and temperature variations - all major concerns in industrial environments.

CONFIGURATION

SECTION 2

JUMPERS

The TEK-234 was designed to allow for minimal hardware configuration.

The following Jumpers can be configured by using shorting jumpers.

JUMPER	STATE	FUNCTION <i>* as shipped</i>
--------	-------	------------------------------

Flash EPROM

W1	Open	No Flash
W1	Closed*	Flash Installed

RAM Disk Memory Type

W2(A-B)	32K x 8, 128K x 8 SRAM
W2(B-C)	256K x 8, 512K x 8 SRAM

RAM Battery Back-up¹

W3	Open* NC
W3	Closed Vbatt

Watchdog Timer

W4	Open* Disable
W4	Closed Enable

1

Vbatt must be installed to save configuration information at power down.

Push Button Reset

W6 (J5-9) *Open* Not Available*

W6 (J5-9) *Closed Available*

Keyboard Inhibit

W7 (J5-9) *Open* Keyboard Available*

W7 (J5-9) *Closed Keyboard Inhibit*

Boot From Flash EPROM

SW1(1-2) *Open* Boot From Drives*

SW1(1-2) *Closed Boot From Flash*

Color/Monochrome

SW1(3-4) *Open* Mono, EGA, VGA*

SW1(3-4) *Closed Color CGA Only*

Console Is VT100 Terminal

SW1(5-6) *Open* Standard Display Mode*

SW1(5-6) *Closed VT100 Mode*

Remote Download

SW1(7-8) *Open* Normal*

SW1(7-8) *Closed Serial Download Mode*

Refer to *Diagram 2-1* and *Table 2-1* for exact jumper locations.

TABLE 2-1 CONFIGURATION JUMPERS

Jumper	Function
W1	Flash EPROM (Vpp)
W2(A-B)	SRAM Memory Type: 32kx8, 128kx8
W2(B-C)	SRAM Memory Type: 256kx8, 512kx8
W3	RAM Battery Backup
W4	Watchdog Timer
W5	Not Used
W6	Push Button Reset
W7	Keyboard Inhibit
W8	Connect INTRQ2 to IRQ3
W9	Connect J7-6 to IRQ14
W10	Connect INTRQ1 to IRQ4
W11	Connect J7-16 to IRQ7
W12	Connect J7-14 to IRQ6
W13	Connect J7-12 to IRQ5
W14	Connect J7-10 to IRQ4
W15	Connect J7-8 to IRQ3
SW1(1-2)	Boot From Flash EPROM
SW1(2-3)	Color/Monochrome
SW1(3-4)	Boot From VT100
SW1(4-5)	Remote Download



Insert jumper switch to connect W8 through

W15.

2-1 JUMPER LOCATIONS

BIOS SETUP

The TEK-234 is fully software configurable. The setup program allows for minimal hardware configuration.

Setup Utility

The SETUP program is located within the BIOS and can be activated at boot time by pressing <CTRL-ALT-S> in *Standard Display Mode*, or <CTRL-R> in *VT100 Mode*, at the configuration prompt during the power up sequence. Once the SETUP screen is displayed you can modify the date, time, or other setup information contained in the clock CMOS RAM.

The system will reboot on exit from SETUP. The SETUP program should only be activated when all information in the computer has been properly saved.

Use the arrow keys to select the item you want to change. When the item is selected, press <+> or <-> keys to change an entry.

Press <F10> to save the current configuration (press "Q" in *VT100 Mode*) and to exit. The configuration, with the exception of the time and date, is not saved until <F10> is pressed. Press <ESC> to exit without saving the setup.

User's Setup Configuration Information

The SETUP program can set the following:

- Time of day and Date*
- Floppy disk configuration*
- Fixed disk configuration*
- System memory size*
- Extended memory size*
- EMS memory size*
- Video type*
- Execute BIOS from RAM or ROM Shadow*
- Wait state selection*
- Initial CPU speed*

MEMORY AND I/O MAP

SECTION 3

MEMORY MAPPING

The TEK-234 supports 512 Kbytes or 2 Megabytes of DRAM with parity check for system memory. You also have room onboard for solid state disks (SSDs): U44 allows up to 128K bytes of EPROM for the BIOS and U42-U43 support from 128K to 512K of user EPROM/FLASH EPROM. Sockets U29 and U38 are reserved for the battery-backed SRAM disk.

EXPANDED AND EXTENDED MEMORY

DRAM on the TEK-234 consists of two areas: memory below 1 Mbyte (0-640K) referred to as the standard or base memory, and memory located above 1 Mbyte which is either *Expanded* or *Extended* memory (memory located between 640K and 1 Mbyte is reserved for *Shadowing*. This is described later in this section).

Expanded and *Extended* memory refer to the mapping scheme that is used to access memory above 1 Mbyte in real mode. Since DOS requires real mode to operate, different techniques are available. The TEK-234 offers the following options:

Expanded Memory

In *Expanded* memory mode, hardware is used to remap a defined area of memory. This mode is driven by standard software commonly referred to as the *LIM Standard* or *EMS*. A hardware-specific device driver (supplied with your single board computer) is loaded in the CONFIG.SYS file to setup the software in order for it to access memory above 1 Mbyte.

Extended Memory

In *Extended* memory mode, the CPU's own protected mode is used to access the memory above 1 Mbyte. This mode requires that the software jump into protected mode, perform the transfer and return back to real mode. This is available through the BIOS using INT 15h function 87h.

TEK-234 Memory Mode

On the TEK-234, memory above 1 Mbyte can be defined either as *EMS* or *Extended*. If *EMS* is used, the *EMS* hardware must be enabled² and the *EMS* driver loaded³.

2

EMS is enabled by pressing <CTRL-ALT-S> at boot up. The EMS option is located on page 2 of the setup screen.

3

User must type the following command in the CONFIG.SYS file: DEVICE=SCATEMM.SYS

Shadow RAM

As previously mentioned, memory between 640K and 1 Mbyte is used for *Shadow RAM* or *Shadowing*. This is simply the process of copying EPROM based code, such as the BIOS and BIOS extensions, into DRAM (which is located in the same physical memory map). *Shadowing* allows your code to run faster.



If Shadow RAM is enabled, the RAM memory used for shadowing is no longer available as EMS or Extended memory.

Configuring The TEK-234

Configuring your TEK-234 is purely a matter of the application at hand. As an example, a 2 Mbyte system can be defined as 640K base + 384K shadow + 1 Mbyte extended memory, or, 640K base + 384K shadow + 512K extended + 512K EMS and so on. The user is free to adapt the configuration to his particular needs.

TABLE 3-1 TEK-234 MEMORY MAPPING

DFFFFF D80000	U43 Flash EPROM
D7FFFF D00000	U42 Flash EPROM
CFFFFF C80000	U38 RAM Backup
C7FFFF C00000	U29 RAM Backup
BFFFFF 200000	Not Decoded Available to User
IFFFFF 100000	1 Mbyte User RAM
0FFFFF 0F0000	64K BIOS
0EFFFF 0EC000	BIOS Extension
0EBFFF 0C0000	Not Decoded Available to User
0BFFFF 0A0000	128K Video RAM
09FFFF 000000	640K User RAM

I/O MAP

The following table outlines the I/O ports used by the TEK-234:

TABLE 3-2 ONBOARD DECODED I/O MAP

ADDRESS	FUNCTION
000-00F	DMA controller 1
020-03F	Interrupt controller 1
040-05F	Timer
060-06F	Keyboard (8742)
070-07F	Real-time clock, NMI mask
080-09F	DMA page register
0A0-0BF	Interrupt controller 2
0C0-0DF	DMA controller 2
0F0-0FF	Math coprocessor
1F0-1F7	Hard disk
2X8-2XA	EMS register, X=0 or 1
201	Watchdog timer, PDO, user
378-37A	LPT1
2F8-2FF	COM2
3F2-3F7	Floppy disk
3F8-3FF	COM1

ONBOARD UTILITIES

SECTION 4

DMA CONTROLLER (8237)

The TEK-234 supports seven direct memory access (DMA) channels. Two DMA controllers, functionally equivalent to the 8237, are used with four channels on each chip. Channel 0 is reserved for the DRAM refresh. Channel 4 is used to cascade channels 0 through 7 to the microprocessor, and Channel 2 is reserved for the floppy controller.

TABLE 4-1 8237 CONTROLLER TABLE

DMA 0	Refresh
DMA 1	Available
DMA 2	Floppy controller
DMA 3	Available
DMA 4	Cascade controller # 1
DMA 5	Available
DMA 6	Available
DMA 7	Available

INTERRUPT CONTROLLER (8259)

Two 8259 interrupt controllers handle the interrupts on the TEK-234. Six interrupt lines are directly linked to the keyboard controller timer, the real-time clock, both serial ports and the parallel port.

TABLE 4-2 8259 CONTROLLER TABLE

CONTROLLER # 1	CONTROLLER # 2
----------------	----------------

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IRQ 0	Timer 0	IRQ 8	Real-time clock*
IRQ 1	Keyboard	IRQ 9	Available
IRQ 2	Cascade controller # 2	IRQ 10	Available
IRQ 3	COM 2*	IRQ 11	Available
IRQ 4	COM 1*	IRQ 12	Available
IRQ 5	Available	IRQ 13	Available
IRQ 6	Floppy controller	IRQ 14	Fixed disk*
IRQ 7	LPT 1*	IRQ 15	Available

* All functions marked with an asterisk (*) can be disabled.

TABLE 4-3 J7 INTERRUPT CONNECTOR

PIN NUMBER			PIN NUMBER		
SIGNAL FLOW			SIGNAL FLOW		
SIGNAL			SIGNAL		
IOWR*	I	1	2	O	T/C*
IORD*	O	3	4	O	AEN*
DACK1*	I	5	6	I	IRQ14
NC	-	7	8	I	IRQ3
DACK3*	I	9	10	I	IRQ4
DREQ1	O	11	12	I	IRQ5
NC	-	13	14	I	IRQ6
DREQ3	O	15	16	I	IRQ7

DIAGRAM 4-1 J7 INTERRUPT CONTROLLER



TIMER (8254)

The 8254 timer features three independent 16-bit timer/counters. Channel 0 is tied to interrupt 0, channel 1 is used to generate refresh with DMA Channel 0, and channel 2 is used for the speaker port.

KEYBOARD CONTROLLER

The keyboard controller on the TEK-234 is a single-chip microcomputer (Intel 8042) that is programmed to support the keyboard serial interface.

The keyboard controller receives serial data from the keyboard, checks data parity, translates scan codes, and presents the data to the system as a byte of data in its output buffer. The controller can interrupt the system when data is placed in its output buffer, or wait for the system to

poll its status register to determine when data is available.

TABLE 4-4 KEYBOARD CONTROLLER

ADDRESS		REGISTER
060	read	keyboard output buffer register
060	write	data write
064	read	Status register
064	write	Command write

KEYBOARD , SPEAKER, RESET and KEYLOCK INTERFACE

Connector J5 on the TEK-234 provides all the necessary signals for connecting the keyboard, speaker, reset, and keylock interface devices. The following diagram shows the signal connections at J5 (referred to as the Keyboard Header):

TABLE 4-5 J5 KEYBOARD HEADER

PIN NUMBER			PIN NUMBER		
SIGNAL FLOW				SIGNAL FLOW	
SIGNAL				SIGNAL	
KBDCLK	O	1		2	- GND
KBDATA	O	3		4	- GND
VCC	-	5		6	- VCC
SPKR	O	7		8	- VCC
*	I	9		10	- GND

* This function is *Push Button Reset* if W6 is installed or *Keyboard Inhibit* if W7 is installed.

The following functions are available on the keyboard header, J5:

- i. **Speaker:** An 8 ohm speaker can be directly connected to J5-7 and J5-8. All necessary drivers are on the TEK-234.
- ii. **Keyboard Disable:** The keyboard can be disabled or locked up by shorting J5-9 and J5-10.
- iii. **Reset:** The TEK-234 can be reset by shorting J5-13 and J5-14.

MATH COPROCESSOR

The TEK-234 accepts an 80287, 80C287 or IIT2C87 math coprocessor in socket U5. The coprocessor works in parallel with the microprocessor. The parallel operation decreases operating time by allowing the coprocessor to do mathematical calculations while the microprocessor continues to do other functions.

The presence of the math co-processor is automatically detected by the BIOS.

SUPERVISOR UTILITIES

Special Note on Register 201 (hex)

IBM PCs use address 201 (hex) as the game port. Teknor computers utilize this address space in a manner which gives industrial PC users the greatest amount of I/O addressing space possible. This ultimately renders the game port unusable.

Hence, some problems may occur with various test software packages that intentionally write to the game port and leave it with unknown values.

The following diagram illustrates how Teknor computers utilize Register 201 (hex):

TABLE 4-6 REGISTER 201 (hex)

Bit	Function
0	Enable Watchdog (1=enable, R/W bit)
1	Watchdog activate (1-0-1 to toggle, R/W bit)
2	Flash VPP enable (1=VPP 12v, 0=VPP 5v, R/W bit)
3	Enable direction control RS-485 (1=enable, RS-485 only, write only)
4	Make printer 8 data bits only ⁴ (1=input, 0=output, write only)
5	Not Used
6	Not used
7	Not used

☞ **Not all bits are R/W. Therefore, be certain to keep a mirror image of register 201(hex) when programming it.**

☞ **All bits are 0 after a hardware RESET or power up condition.**

Watchdog Timer

The *Watchdog Timer* is extremely useful in embedded systems where human supervision is not required.

Following a reset, the *Watchdog* is always disabled. The *Watchdog* is enabled once you write "1" in bit "0" at address 201(hex) the first time. When enabled, the microprocessor must refresh the *Watchdog*. This is done by writing alternatively "0" and "1" to bit 1 at address 201(hex), once every 1.6 seconds to verify proper software execution.

If a hardware or software failure occurs such that the *Watchdog* is not refreshed, a reset pulse is generated by the *Watchdog* to restart the processor.



The user program must provide the first access to address 201(hex), and must also include the refresh routine. In addition, be certain to keep a mirror image of register 201(hex) when programming it. This is necessary since register 201(hex) is a write-only user register and, as a result, is not used by the BIOS.

TABLE 4-7 WATCHDOG TIMER REGISTER

ADDRESS		REGISTER
201 bit 0	read/write	Watchdog enable
201 bit 1	read/write	Watchdog refresh

Watchdog Configuration

Jumper W4 must be installed to permit activation of the *Watchdog*. If jumper W4 is removed, the *Watchdog* is

disabled.

REAL-TIME CLOCK

The RTC is compatible with the popular MC146818. It combines a complete time-of-day clock with a one-hundred year calendar, an alarm, a programmable periodic interrupt, and 114 bytes of low-power static RAM. A battery backup facility is provided for the RTC. The internal clock circuitry uses 14 bytes of this RAM, and the rest is reserved for configuration information.

PARALLEL PORT (LPT1)

The parallel port is 100% PC/AT compatible. It provides the necessary control signals for use as a Centronics-compatible parallel interface. The connection is done through a DB-25 connector, J7, located at the edge of the board.

TABLE 4-8 LPT1 (J7)

PIN NUMBER			PIN NUMBER		
SIGNAL FLOW			SIGNAL FLOW		
SIGNAL			SIGNAL		
STB*	O	1	2	I/O	AFD*
P0	I/O	3	4	I	ERR*
P1	I/O	5	6	O	INIT*
P2	I/O	7	8	O	SLIN*
P3	I/O	9	10	-	GND
P4	I/O	11	12	-	GND
P5	I/O	13	14	-	GND
P6	I/O	15	16	-	GND
P7	I/O	17	18	-	GND
ACK*	I	19	20	-	GND
BUSY	I	21	22	-	GND
PE	I	23	24	-	GND
SLCT	I	25	26	-	GND

The LPT1 header can be turned into a DB25 connector (similar to those found on PCs) simply by using a flat ribbon cable crimped with a 26-pin header at one end and a 25-pin D-SUB connector at the other. When doing this, make certain that pin 1 is aligned on both ends and do not forget to remove wire #26 from the cable.

Changing Direction on LPT1

The 8 bit data is set to *output* by default. It can be changed to 8 bit *input* simply by writing 10h to address 201h (set bit 4).



Port 201h is also used to control the *Watchdog Timer*. Therefore, it is highly recommended you keep a mirror image of port 201h in memory.

SERIAL COMMUNICATION PORTS

The TEK-234 features two UARTs which are functionally equivalent to the NS16450. They are both configured as DTE. The COM1 (J6) port is buffered directly on the board for RS232 operation. The COM2 port is buffered for RS232 or for RS485. If you require RS485 on COM2, you must specify product # TEK-234A or as OPT-300 when placing your order.

COM1 (J6) Hardware Configuration

The COM1 port is configured as RS232, and is 100% compatible with the IBM-AT serial port.

TABLE 4-9 COM1 & COM2 (J6)

PIN NUMBER				PIN NUMBER		
SIGNAL FLOW				SIGNAL FLOW		
SIGNAL				SIGNAL		
DCD	I	1	2	I	DSR	
RXD	I	3	4	O	RTS	
TXD	O	5	6	I	CTS	
DTR	O	7	8	I	RI	
GND	-	9	10	-	NC	
DCD2	I	11	12	I	DSR2	
RXD2	I	13	14	O	RTS2	
TXD2	O	15	16	I	CTS2	
DTR2	O	17	18	I	RI2	
GND	-	19	20	-	NC	

COM2 (J6) as RS485

If the TEK-234 is configured for RS485 operation. It can support either full-duplex or party line communication.

Full Duplex Operation

Upon power-up or reset, the RS485 interface circuits are automatically configured for full duplex operation. J6(11,13) act as the receiver lines and J6(15,20) as the transmitter lines.

Party Line Operation

In order to enable party line operation, the user must first write "1" to bit 3 at I/O address 201. This allows the transceiver (J6 15,20) to be controlled by the RTS signal. Upon power-up or reset, the transceiver is by default in "receiver mode" in order to prevent unwanted perturbation on the line.

In party line operation, termination resistors R9A and R9B must be installed only on the boards at both ends of the network.

TABLE 4-10 COM2 (J6) RS485

PIN NUMBER			PIN NUMBER		
SIGNAL FLOW			SIGNAL FLOW		
SIGNAL			SIGNAL		
RXD2 (-)	I	11	12	-	NC
RXD2 (+)	I / O	13	14	-	NC
TXD2 (+)	O	15	16	-	NC
NC	-	17	18	-	NC
GND	-	19	20	-	TXD2 (-)

POWER MANAGEMENT

Average system power consumption can be reduced by deactivating or slowing the chip set and processor clock during idle periods.

If a non-static CPU is used, the processor clock can be slowed down. By using a static CPU, the processor clock can be stopped completely.

On the TEK-234 a "sleep mode" is provided in which a HALT instruction executed by the CPU triggers the slowing or stopping of PROCCLK.

Using Sleep Mode

Sleep Mode can be enabled by software. The low power mode or *Sleep Mode* turns off the floppy disk controller, the crystal oscillator, both UARTS and the processor. CMOS technology consumes more power when it is made to oscillate faster. Therefore, by reducing the oscillating speed of the chip set and processor, overall power consumption is also greatly reduced.

In *Sleep Mode*, power consumption of the TEK-234 is reduced to approximately 700mw.



The NEC 80C42 keyboard controller is recommended for low power operation.

If more details are required, please contact our technical support department.

FLOPPY DISK CONTROLLER

The floppy disk controller on the TEK-234 is IBM PC and AT compatible (single and double density). It handles 3.5 inch and 5.25 inch low and high density drives. Up to two drives can be supported in any combination.

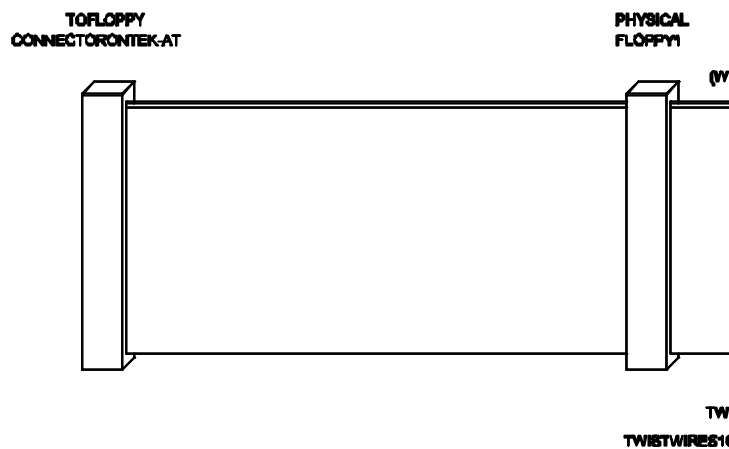
Mechanical Floppy Disk Installation

The installation of floppy drives on the TEK-234 is done via a standard IBM 34-pin flat ribbon cable that connects to J2. The pin-out is described below:

TABLE 4-11
FLOPPY DISK CONNECTOR PIN OUT (J2)

Pin Number	Signal Flow	Signal
2	O	RPM/LC
4	-	N.C.
6	-	N.C.
8	I	INDEX*
10	O	MOTRENA*
12	O	DRIVESB*
14	O	DRIVESA*
16	O	MOTRENB*
18	O	DIRC*
20	O	STEP*
22	O	WRITE DATA*
24	O	WRITE ENABLE*
26	I	TRACK0*
28	I	WRITE PROTECT*
30	I	READ DATA*
32	O	HEAD SELECT*
34	I	DCHG
1-33 (ODD)	-	GND

DIAGRAM 4-2 FLOPPY DISK CABLE



HARD DISK CONTROLLER

The TEK-234 supports AT Integrated Disk Drives. The AT embedded drive architecture incorporates drive electronics and controller circuitry on a single printed circuit board which is mounted directly to the disk drive chassis. The integration of drive and controller functions increases reliability and performance by eliminating redundant circuitry. Thus, providing increased performance at reduced cost.

Hard Disk Installation

To connect an IDE hard disk to the TEK-234, a 40-pin

dual row header signal connector is required. This connector handles all command, data, and status I/O lines. The 40-pin male header connector located at J1 on the TEK-234 connects directly with the cable. A maximum cable length of 18 inches is recommended.

The drive itself can be mounted in any horizontal or vertical plane. The hard drive must be indicated in the CMOS setup. The number of cylinders, heads, sectors per track, landing zone, and write precompensation must all be specified. This is done through selecting a standard drive type listed in the setup screen or by using a user defined drive type (type 48), whereby the user can enter the required parameters.

Your drive manufacturer can supply this information.



The onboard hard disk interface can be disabled on the TEK-234 by installing jumper W3.

**TABLE 4-12 HARD DISK CONNECTOR
PIN OUT (J1)**

Pin Number	Signal Flow	Signal
3	I/O	SD7
4	I/O	SD8
5	I/O	SD6
6	I/O	SD9
7	I/O	SD5
8	I/O	SD10
9	I/O	SD4
10	I/O	SD11
11	I/O	SD3
12	I/O	SD12
13	I/O	SD2
14	I/O	SD13
15	I/O	SD1
16	I/O	SD14
17	I/O	SD0
18	I/O	SD15
1	I	RST*
23	I	IOW*
25	I	IOR*
33	I	SA1
35	I	SA0
36	I	SA2
37	I	CS0*
38	I	CS1*
31	O	IRQ14
32	O	I/OCS16*
39	O	ACTIVE*
20	-	KEY (NOT CONNECTED)
21	-	RESERVED (NOT CONNECTED)
34	-	PDIAG
2, 19, 22, 24	-	GND
26, 30, 40		

SOLID STATE DISKS

The TEK-234 has two 32-pin sockets that can be used for solid state (semiconductor) disks. Solid state disks (SSDs) have no moving parts and are far less susceptible to dirt, moisture, vibration and temperature variations than mechanical floppy disks. Two types of SSDs are available on the TEK-234, Flash EPROM and Static-RAM (SRAM).

Flash EPROM Disk

The non-volatile characteristics of Flash memory eliminate the risk of losing valuable data updates (a concern with battery backed SRAM). As a result, Flash memory offers major advantages in applications like automated factories, remote systems, portable equipment and similar environments. Plus, Flash memory is obtainable at a much lower cost than EEPROM or battery-backed SRAM.

The TEK-234 comes with two, 32-pin sockets available for use as Flash disks. Flash devices are available in 128K or 256K densities. You can configure your TEK-234 with 128K, 256K or 512K of Flash memory.



Up to two Flash devices can be installed on the TEK-234 to provide you up to 512Kbyte of memory. Although both 128K and 256K devices are supported, the device types cannot be mixed in a single drive. That is, drive A, for example, must be either all 128K devices or 256K devices.

Flash disks "look" identical to floppy disks. Therefore, all the functions that can be performed on floppy disks are available on the Flash disks: e.g. booting, reading, copying, and so on. The only difference between the two drive types is that Flash disks are read only. Hence, whenever an attempt is made to write to the Flash disk, a write-protect error is generated. Writing to Flash disks is explained below and also in Teknor's *XFLASH User's Manual*.

User EPROM/Flash EPROM Disk

The TEK-234 supports two 32-pin Lead PLCCs for user EPROM and/or **Intel/AMD Flash EPROMS, model 28F010, 128Kx8 or model 28F020, 256Kx8.**

Sockets U42-U43 are configured to accept these devices. The virtual disk utility automatically detects what type of device is installed and how much memory is present.



Jumper W1 on the TEK-234 must be installed when Flash EPROM devices are present. If EPROM devices are installed, remove jumper W1.

Writing To Flash Disks

To create a Flash disk (i.e. writing information to it), use the XFLASH utility found on the utilities diskette which came with this board.

The XFLASH software utility allows you to choose files from floppy and hard disks and write them to the Flash disks.

Information can be transferred to the Flash disk by directly running XFLASH on the TEK-234 computer, or remotely - by using a serial link. The second option is referred to as *Download Mode* and is enabled by installing jumper SW1(7-8).

In addition, the Flash disk can be made to boot simply by installing SW1(1-2). This function causes the Flash disk to replace floppy disk 0 from the "A" position - leaving the mechanical floppy unused. Floppy 0 must then be physically moved to the floppy 1 position where it becomes the "B" drive. Please refer to the *Physical Devices Table* for more information.

Using EPROMs

Regular EPROMs (27C020) can be used in the place of Flash EPROM devices. The code that is to be downloaded into the EPROMs can be generated by XFLASH, but an EPROM programmer is needed to transfer the code.



EPROMs cannot be programmed directly

onboard. Only Intel 27C020 EPROM devices are supported by the TEK-234.

Remember to remove jumper W1 if EPROM devices are used.

SRAM Disk

The TEK-234 comes with two SRAM sockets which are automatically configured as a read/write battery-backed SRAM disk.

The SRAM disk also "looks" just like a floppy disk since you can read and write directly to it using regular DOS commands. The only limitation is that SRAM disk is not bootable. Therefore, the boot process must take place in either the Flash disk, floppy 0 or hard disks.

The TEK-234 supports 32Kx8, 128Kx8, 256Kx8 and 512Kx8 devices. The SRAM disk can be configured from 32K to 1Mbyte. The SRAM devices cannot be mixed, but the SRAM disk may be made up of a single device if so desired.



If a single SRAM device is used it must be installed on the lower socket, i.e. the one closest to the bus connector.

Once installed, the device types must be configured on the board as follows:

TABLE 4-13 STATIC-RAM DISK

JUMPER	FUNCTION
W2(1-2)	32kx8 and 128kx8 devices
W2(2-3)	256kx8 and 512kx8 devices

If SRAM disk operation is not desired, but battery-backed SRAM memory is needed, simply install a device on the top socket (i.e. the one farthest from the bus connector). The BIOS will then ignore this device leaving its contents intact.



Files transferred to battery-backed RAM disks stay resident for a minimum of one year; five years typically.

Battery Backup Circuit

A 350maH or 1AH (optional) lithium battery is installed on the TEK-234. If the TEK-234 is strapped to be powered by the battery back-up, the RAMs will retain their information after a power down.

TABLE 4-14 BATTERY BACKUP CIRCUIT

JUMPER		FUNCTION
W3	open	NC
W3	closed	Vbatt

☞ **Removing jumper W3 will cause the set-up and real-time clock information to be lost.**

The TEK-234 comes with a 350 maH TL5186 TADIRAN battery with a shelf life of approximately 10 years (under "no-load" conditions).

TEK-234 draws approximately 18uA typical. This means the battery will last 2.5 years if no power is applied to the board. Remember, when the 5V is supplied, the battery is electronically disconnected. Virtually as if it were on the shelf.

The actual life of the battery depends on the amount of time DC power is not applied and on environmental (temperature) conditions. The TADIRAN TL5186 has an operating range of -55⁰ to 75⁰C and discharge characteristics vary with temperature.

The TADIRAN TL5186 is U.L. recognized. Its U.L. component recognition is MH12193.

☞ **The actual voltage supplied by the battery is**

3.6 volts. This can be verified at pins 16-32 on the SRAM sockets using a standard voltmeter.

CONFIGURATION JUMPERS (SW1)

The TEK-234 has an onboard BIOS extension which controls certain functions of the BIOS related to industrial applications. The extended BIOS reads the status of the jumpers(SW1) and acts accordingly.

Upon system start-up, the BIOS automatically determines how much ROM/RAM disk memory is available to the system, and what equipment is connected to the system. Jumpers SW1 will be set by the user as needed. The following diagram lists the available modes:

TABLE 5-1 SW1 JUMPER SETTINGS

JUMPER	FUNCTION
SW1(1-2)	Boot From Flash Devices
SW1(3-4)	Mono/color
SW1(5-6)	Boot From VT100 Terminal
SW1(7-8)	Activate Serial Download Mode

LOGICAL DISK CONFIGURATION

The TEK-234 can detect two semiconductor drives - A Flash EPROM disk drive and a battery-backed SRAM disk drive.

These drives are installed as follows:

If SW1(1-2) is installed (i.e. booting MS-DOS from Flash

EPROMs), then Drive A: is the Flash Disk (assuming a valid Flash Disk is placed in sockets U20 - U23). Drive B: is Floppy 1 (if installed) or the next available drive according to the following list of priorities:

- 1- Floppy 1
- 2- Flash Disk if not already installed as A:
- 3- RAM Disk (if installed)
- 4- Hard Disk (if installed)

Subsequent logical drives are installed following the above priority list.

If SW1(1-2) is **not** installed (i.e. booting operating system from F/H drives), then Drive A: is Floppy 0. Drive B:, and subsequent drives, follow the priority list above.

Please refer to the *Physical Devices Table* for complete information.



The RAM disk is automatically detected and installed upon booting. The beginning of the disk is checked and reformatted if it is found to be corrupt or if data is unrecognizable.

TABLE 5-2 PHYSICAL DEVICES TABLE

PHYSICAL DEVICES INSTALLED & DRIVE ASSIGNMENTS						
CONFIGURATION AND PHYSICAL DEVICES INSTALLED	JUMPER OR NO JUMPER FLOPPY 0 FLOPPY 1 NO FLASH DISK	NO JUMPER FLOPPY 0 FLOPPY 1 FLASH DISK	JUMPER FLOPPY 0 OR NO FLOPPY 0 FLOPPY 1 FLASH DISK	NO JUMPER FLOPPY 0 FLASH DISK	JUMPER FLOPPY 1 FLASH DISK	JUMPER FLASH DISK
DRIVE NAME:						
A:	FLOPPY 0	FLOPPY 0	FLASH	FLOPPY 0	FLASH	FLASH
B:	FLOPPY 1	FLOPPY 1	FLOPPY 1	FLASH	FLOPPY 1	AVAILABLE
C:	AVAILABLE	FLASH	AVAILABLE	AVAILABLE	AVAILABLE	AVAILABLE
D:	AVAILABLE	AVAILABLE	AVAILABLE	AVAILABLE	AVAILABLE	AVAILABLE

NOTES: The indication "FLASH DISK" assumes at least one Flash device is installed at U26 with a valid DOS content.
 "Floppy 0" specifies the physical drive connected to the twisted end of the flat cable. "Floppy 1" specifies

the physical drive connected to the untwisted end of the flat cable. "Jumper" specifies configuration Jumper SW1(1-2). All other drives are installed following the above assignments in this manner: RAM Disk, and then Hard Disk. Therefore, with a full configuration, RAM Disk is "D" and the Hard Disk is "E".

VT100 OPERATION (SW1(5-6))

The TEK-234 utilizes a feature known as *VT100 MODE*.

This mode enables your single board computer to run without a local keyboard or screen. That is, operation can be controlled via a remote terminal or a computer with a terminal emulation program.

Requirements

To use *VT100 Mode*, the TEK-AT board must be supplied with +/- 12 volts. This is the voltage required by the RS232 drivers.

The terminal you are using should emulate a VT100 or ANSI terminal. Although this is not an absolute requirement, strange characters may appear on screen if it does not. This occurs because the VT100 recognizes these control characters, and causes them to perform a specific function. For example, screen erase, cursor position, and so on.

Hardware Setup And Configuration

Follow these steps to setup for *VT100 Mode*:

- Install jumper SW1(5-6) to enable *VT100 Mode*
{note: *VT100 Mode* runs on COM1 (3F8H)}.
- Setup the communications cable as shown in *Diagram 5-1* {Note: If you do not require a full cable for your terminal, you can setup a partial cable using only the TXD and RXD lines. The control lines can be ignored by looping them back as shown in *Diagram 5-2*}.

- Boot up your terminal and set it up with the following parameters:

19200 Baud
8 Bits
No Parity
Echo off (or full duplex)

☞ **Use CTRL-R to configure your system in VT100 Mode.**

Running Without A Terminal

If you wish to disconnect the VT100 terminal or if you decide to run without a terminal, you must ensure the control lines are in an active state. Failing this, the system may "hang" while waiting for the control lines to become active. Wiring the system according to *Diagram 5-2* allows the lines to remain active.

Furthermore, you can run without any console at all simply by not enabling VT100 mode and by not installing a video card.

DIAGRAM 5-1 FULL SETUP

DIAGRAM 5-2 PARTIAL SETUP

DISK DRIVES AND SEMI CONDUCTOR DISKS

All disk drives and semi conductor disks operate identically in both regular and VT100 mode, and all drive assignments remain the same.

Downloading software to Flash devices is done through XFLASH, Teknor's transfer utility software. Please refer to the *XFLASH User's Manual* for details.

BAUD RATE RESTRICTIONS

The baud rate is re-initialized each time a call to INT 10H (display to console) is made. This is due to some software programs, such as MS-DOS, changing the baud rate when loading.

GRAPHICS/STAND-ALONE

The TEK-234 can operate without any video controller, keyboard or mechanical drives. It will automatically detect the presence of video, keyboard and mechanical drive devices and act accordingly.

The TEK-234 can be used with the TEK-PG VGA card or any IBM compatible graphics controller card. Before starting the system, the user should also verify that the color monitor attached to the system can support the desired graphics mode.

OVERVIEW AND FEATURES

The TEK-234 uses the CHIPS AND TECHNOLOGY PC/AT BIOS. This BIOS provides a software interface between the MS-DOS operating system and the hardware of the TEK-234 single-board computer. The interface provided by the BIOS is 100% IBM AT compatible. That is, all functions accept similar inputs and provide the same results as IBM, although the program code itself is different.

ERROR HANDLING

Teknor BIOS can be configured to handle errors differently. Two possibilities exist:

- | | |
|-----------------|--|
| <i>Stop:</i> | The BIOS will stop the booting process if an error is detected and request the user to press F1. |
| <i>Warning:</i> | The BIOS will display an error message but will continue the booting procedure |

The following lists the error sources and their default values.

<i>[Warning]</i>	<i>Diskette</i>
<i>[Warning]</i>	<i>Fixed Disk</i>
<i>[Warning]</i>	<i>Keyboard</i>
<i>[Warning]</i>	<i>Video</i>
<i>[Warning]</i>	<i>Memory size</i>
<i>[Warning]</i>	<i>CMOS checksum</i>
<i>[Stop]</i>	<i>Timer</i>
<i>[Warning]</i>	<i>Real-Time Clock</i>
<i>[Warning]</i>	<i>POST configuration</i>
<i>[Warning]</i>	<i>Coprocessor</i>
<i>[Warning]</i>	<i>Other</i>

SPECIFICATIONS

SECTION 7

TEK-234 DC CHARACTERISTICS

Supply Voltage Vcc min.:	4.75V
	Vcc max.: 5.25V
	+12V: +/-5%
	-12V: +/-5%
Supply Current	Icc typ. ⁵ 850ma
	Icc stby. 200ma
	Ipp +12V 10ma
	Ipp -12V 5ma

TEK-234 ENVIRONMENTAL SPECIFICATIONS

Operating Temperature:

0⁰C to 70⁰C

-40⁰C to +85⁰C Available

Non-Condensing relative humidity:

5% to 95%

DIAGRAM 7-2 ASSEMBLY

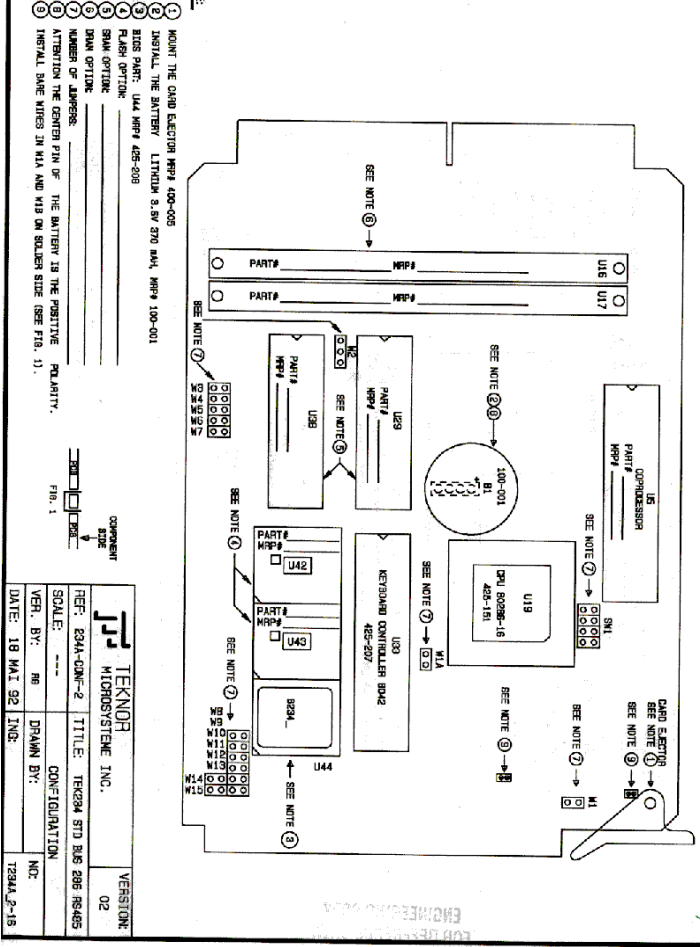
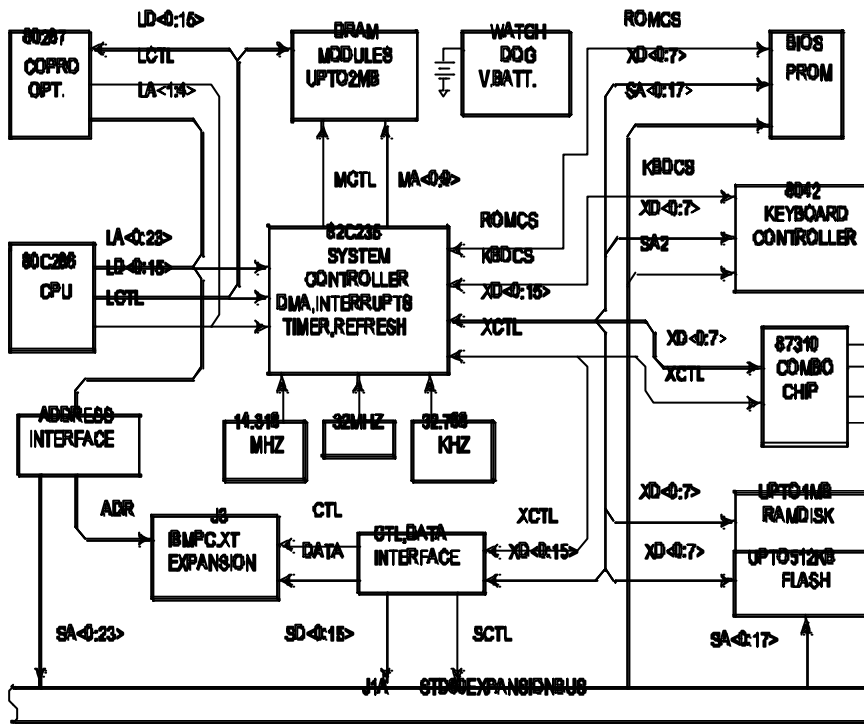


DIAGRAM 7-3 BLOCK DIAGRAM



CONNECTOR OVERVIEW

J5 KEYBOARD CONNECTOR

PIN NUMBER				PIN NUMBER		
SIGNAL FLOW					SIGNAL FLOW	
SIGNAL						SIGNAL
KBDCLK	O	1		2	-	GND
KBDDATA	O	3		4	-	GND
VCC	-	5		6	-	VCC
SPKR	O	7		8	-	VCC
*	I	9		10	-	GND

* This function is *Push Button Reset* if W6 is installed or
Keyboard Inhibit if W7 is installed.

J4 PRINTER CONNECTOR

PIN NUMBER			PIN NUMBER		
SIGNAL FLOW			SIGNAL FLOW		
SIGNAL			SIGNAL		
STB*	O	1	2	I/O	AFD*
P0	I/O	3	4	I	ERR*
P1	I/O	5	6	O	INIT*
P2	I/O	7	8	O	SLIN*
P3	I/O	9	10	-	GND
P4	I/O	11	12	-	GND
P5	I/O	13	14	-	GND
P6	I/O	15	16	-	GND
P7	I/O	17	18	-	GND
ACK*	I	19	20	-	GND
BUSY	I	21	22	-	GND
PE	I	23	24	-	GND
SLCT	I	25	26	-	GND

J6 COM1 & COM2 CONNECTOR

PIN NUMBER				PIN NUMBER		
SIGNAL FLOW				SIGNAL FLOW		
SIGNAL				SIGNAL		
DCD	I	1		2	I	DSR
RXD	I	3		4	O	RTS
TXD	O	5		6	I	CTS
DTR	O	7		8	I	RI
GND	-	9		10	-	NC
DCD2	I	11		12	I	DSR2
RXD2	I	13		14	O	RTS2
TXD2	O	15		16	I	CTS2
DTR2	O	17		18	I	RI2
GND	-	19		20	-	NC

J7 INTERRUPT CONNECTOR

PIN NUMBER			PIN NUMBER		
SIGNAL FLOW			SIGNAL FLOW		
SIGNAL			SIGNAL		
IOWR*	I	1	2	O	T/C*
IORD*	O	3	4	O	AEN*
DACK1*	I	5	6	I	IRQ14
NC	-	7	8	I	IRQ3
DACK3*	I	9	10	I	IRQ4
DREQ1	O	11	12	I	IRQ5
NC	-	13	14	I	IRQ6
DREQ3	O	15	16	I	IRQ7

J1A STD BUS CONNECTOR

I/O PIN	Signal Name	I/O	I/O PIN	Signal Name	I/O
1	+5V	-	2	+5V	-
3	GND	-	4	GND	-
5	NC	-	6	NC	-
7	D3	I/O	8	D7	I/O
9	D2	I/O	10	D6	I/O
11	D1	I/O	12	D5	I/O
13	D0	I/O	14	D4	I/O
15	A7	O	16	A15	O
17	A6	O	18	A14	O
19	A5	O	20	A13	O
21	A4	O	22	A12	O
23	A3	O	24	A11	O
25	A2	O	26	A10	O
27	A1	O	28	A9	O
29	A0	O	30	A8	O
31	WR*	O	32	RD*	O
33	IORQ*	O	34	MEMRQ*	O
35	IOEXP	O	36	NC	-
37	REF*	O	38	MCSYNC*	O
39	NC	-	40	NC	-
41	BUSAK*	I	42	NC	-
43	NC	-	44	INTRQ1*	I
45	IOCHRDY†	I	46	NMIRQ*	I
47	SYSRES*	O	48	PBRES*	I
49	SYSCLK‡	O	50	INTRQ2*	I
51	PCO	O	52	PC1	I
53	GND	-	54	GND	-
55	+12	-	56	-12	-

† (WAITRQ*)

‡ (CLOCK*)

J3 PIGGYBACK CONNECTOR

A Side

	I/O PIN	Signal Name	I/O
1	A1	-I/O CH CK	I
3	A2	SD7	I/O
5	A3	SD6	I/O
7	A4	SD5	I/O
9	A5	SD4	I/O
11	A6	SD3	I/O
13	A7	SD2	I/O
15	A8	SD1	I/O
17	A9	SD0	I/O
19	A10	-I/O CH RDY	I
21	A11	AEN	O
23	A12	SA19	I/O
25	A13	SA18	I/O
27	A14	SA17	I/O
29	A15	SA16	I/O
31	A16	SA15	I/O
33	A17	SA14	I/O
35	A18	SA13	I/O
37	A19	SA12	I/O
39	A20	SA11	I/O
41	A21	SA10	I/O
43	A22	SA9	I/O
45	A23	SA8	I/O
47	A24	SA7	I/O
49	A25	SA6	I/O
51	A26	SA5	I/O
53	A27	SA4	I/O
55	A28	SA3	I/O

B Side

	I/O PIN	Signal Name	I/O
2	B1	GND	Ground
4	B2	RESET DRV	O
6	B3	+5 Vdc	Power
8	B4	IRQ9	I
10	B5	-5 Vdc	Power
12	B6	DRQ2	I
14	B7	-12 Vdc	Power
16	B8	OWS	I
18	B9	+12 Vdc	Power
20	B10	GND	Ground
22	B11	-SMESW	O
24	B12	-SMEMR	O
26	B13	-IOW	I/O
28	B14	-IOR	I/O
30	B15	-DACK3	O
32	B16	DRQ3	I
34	B17	-DACK1	O
36	B18	DRQ1	I
38	B19	-REFRESH	I/O
40	B20	CLK	O
42	B21	IRQ7	I
44	B22	IRQ6	I
46	B23	IRQ5	I
48	B24	IRQ4	I
50	B25	IRQ3	I
52	B26	-DACK2	O
54	B27	T/C	O
56	B28	BALE	O

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57	A29	SA2	I/O
59	A30	SA1	I/O
61	A31	SA0	I/O

58	B29	+5 Vdc	Power
60	B30	OSC	O
62	B31	GND	Ground

J2 FLOPPY DISK CONNECTOR PIN OUT

Pin Number	Signal Flow	Signal
2	O	RPM/LC
4	-	N.C.
	-	N.C.
	I	INDEX*
6	O	MOTRENA*
	O	DRIVESB*
	O	DRIVESA*
	O	MOTRENB*
8	O	DIRC*
	O	STEP*
	O	WRITE DATA*
	O	WRITE ENABLE*
	I	TRACK0*
10	I	WRITE PROTECT*
	I	READ DATA*
	O	HEAD SELECT*
	I	DCHG
	-	GND
12		
14		
16		

18		
20		
22		
24		
26		
28		
30		
32		

34		
1-33 (ODD)		

J1 HARD DISK CONNECTOR PIN OUT

Pin Number	Signal Flow	Signal
3	I/O	SD7
4		SD8
5	I/O	SD6
6		SD9
7	I/O	SD5
8		SD10
9	I/O	SD4
10		SD11
11	I/O	SD3
12		SD12
13	I/O	SD2
14		SD13
15	I/O	SD1
16		SD14
17	I/O	SD0
18		SD15
1	I/O	RST*
23		IOW*
25	I/O	IOR*
33		SA1
35	I/O	SA0
36		SA2
37	I/O	CS0*
38		CS1*
31	I/O	IRQ14
32		I/OCS16*
39	I/O	ACTIVE*
20		KEY (NOT CONNECTED)
21	I/O	RESERVED (NOT CONNECTED)
34		PDIAG
2, 19, 22, 24	I/O	GND
26, 30, 40		
	T	

	<i>I</i> <i>I</i> <i>I</i> <i>I</i> <i>I</i> <i>I</i> <i>I</i> <i>O</i> <i>O</i> <i>O</i> - - - -	
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LIMITED WARRANTY

SECTION 8

TEKNOR MICROSYSTEMS INC. ("the seller") warrants its products to be free from defects in material and workmanship for a period of two (2) years commencing on the date of shipment. The liability of the seller shall be limited to replacing or repairing, at the seller's option, any defective units. Equipment or parts which have been subject to abuse, misuse, accident, alteration, neglect, or unauthorized repair are not covered by this warranty. This warranty is in lieu of all other warranties expressed or implied.

Returning Defective Merchandise

If your TEKNOR product malfunctions, please do the following before returning any merchandise:

- 1) Call our Technical Support Department at (514) 437-5682. Make certain you have the following at hand: the Teknor Invoice #, your Purchase Order #, and the Serial Number of the defective unit.
- 2) Give the serial number found on the back of the card and explain the nature of your problem to a service technician.
- 3) If the problem cannot be solved over the telephone the technician will further instruct you on the return procedure.
- 4) When returning goods, please include the name

and telephone number of a person whom we can contact for further explanations if necessary.

Where applicable, always include all duty papers and invoice(s) associated with the item(s) in question.

- 5) Prior to returning any merchandise, make certain you receive an RMA # and clearly mark this number on the outside of the package you are returning.
- 6) When returning a TEKNOR card:
 - i) *Make certain that the card is packed in conductive foam pads or conductive plastic bags.*
 - ii) *Place it in a rigid cardboard box.*
 - iii) *Ship prepaid and insured to:*

TEKNOR MICROSYSTEMS INC.

Service Department
31 de la Seigneurie E.
Suite 107
Blainville, Quebec
J7C 4G6 CANADA

GETTING HELP

SECTION 9

Need More Help?

At Teknor, we take great pride in our customer's successes. We strongly believe in providing full support at all stages of your product development.

If at any time you encounter difficulties with your application or with any of our products, or if you simply need guidance on system setups and capabilities, you may contact our Technical Services/Support Department at

Tel: (514) 437-5682

Fax: (514) 437-8053

If you have any questions about Teknor, our products and/or services, you may reach us at the above numbers or by writing to:

TEKNOR MICROSYSTEMS INC.

31 de la Seigneurie E.

Suite 107

Blainville, Quebec

J7C 4G6 CANADA

RECOMMENDED DEVICES AND CONNECTORS

The following is a list of recommended devices and connectors for use on the TEK-234. Many other models are available and function equally well. Users are encouraged to check with their local distributors for comparable substitutes.

DRAM (U16,U17)

DRAM devices with page mode at 80ns maximum access time or better are recommended. E.g.:

SIEMENS HYM910005 (1M x 9)
TOSHIBA THM91000A5-80 (1M X 9)
HITACHI HB56A19B (1M x 9)
OKI MSC2312A159 (1M x 9)

SRAM (U29,U38)

Static RAM CMOS memory with low power consumption for battery backup (no Pseudo-Static) with access time of 200ns, or better. Must be in DIP package. E.g.:

SONY 58256P (32K x 8)
SAMSUNG KM62256ALP (32K x 8)
SAMSUNG KM681000LP (128K x 8)
DENSPAC DPS512S8P (512K x 8)
EDI 8M8512C/LP (512 x 8)
or equivalents.

FLASH EPROM (U42,U43)

Use Flash EPROM's with 200ns access time, or better. Must be in PLCC package. Use only:

INTEL or AMD 28F010 (128K x 8) FLASH EPROM
INTEL or AMD 28F020 (256K x 8) FLASH EPROM
(note: AMD devices may only be used on rev 1.4 BIOS
versions and higher)

MATH COPROCESSORS

IIT	3C87SX-16 for 16Mhz boards
CYRIX	CX-83587-16 for 16Mhz boards

INTERFACE CONNECTORS

The following connectors are recommended for interfacing with the TEK-234 I/O devices. The parts shown here do not have a strain relief but one may be added.

Connector	Recommended Mating Part
Hard Disk (J1)	Robinson Nugent IDS-C40PK-TG (40-pin flat cable crimp header)
Floppy Disk (J2)	Robinson Nugent IDS-C34PK-TG (34-pin flat cable crimp header)
XT Header (J3)	Samtec ESQ131-12-G-D PCB-mount female header
LPT1 (J4)	Robinson Nugent IDS-C26PK-TG (26-pin flat cable crimp header)
KEYBOARD (J5)	Robinson Nugent IDS-C10PK-TG (10-pin flat cable crimp header)
COM1/COM2 (J6)	Robinson Nugent IDS-C20PK-TG (20-pin flat cable crimp header)
INTERRUPTS (J7)	Robinson Nugent IDS-C16PK-TG (16-pin flat cable crimp header)